

Automated Car Number Plate Recognition System using K-Nearest Neighbor

Divya Narula, Manish Mahajan, Kamalinder Kaur

Abstract: *The Automatic number plate recognition (ANPR) is a mass reconnaissance strategy that utilizes optical character recognition on images to peruse the license plates on vehicles. The car number plate detection has the various phases like pre-processing, segmentation and classification. In the previous work, the morphological operation is applied for the car number plate detection. The morphological operation has the low accuracy for the car number plate detection. In the proposed work, the region based segmentation and K-nearest neighbor classification is applied for the character recognition. The proposed is implemented in MATLAB and results are analyzed in terms of accuracy.*

Index Terms: *Number Plate Detection, KNN, K-mean, Morphological Operation.*

I. INTRODUCTION

A technique which is used to obtain valuable information from the raw image is called image processing. An image can be described as two dimensional function $f(x, y)$ in the digital image processing. In this image, x and y are called spatial (plane) coordinates. The amplitude of f at any duo of coordinates (x, y) is termed as the intensity or gray level of the provided image at that point. In digital image processing initially single image is used. An advanced version of the used image is developed using digital image processing. This technique converts a digital image into something except a digital image. The image can be transformed into a set of measurement data, alphabet text, or a decision as well. The digitization process of an image transforms a graphic structure to arithmetical data [1].

In the last five decades, a massive growth was observed in the image processing techniques. Identifying the number plate of vehicle in smart traffic systems is a crucial phase. The recognition of vehicle number plate is called a variety of automatic vehicle identification. The handling of the vehicle is becoming a large issue due to the increased use of vehicles these days. An automatic vehicle detection system has been developed in order to handle the vehicles efficiently. In traffic monitoring structure, the vehicle number plate recognition has a lot of applications. These applications include highway electronic toll compilation, traffic level, vehicle tracing, policing, edge, custom safety and many more

[2]. With the help of image processing techniques, the vehicles can be recognized through just their number plates as all vehicle have a distinctive number plate. The recognition of vehicle number plate is a branch of digital image processing. This approach is normally utilized in vehicle transport scheme for classifying the vehicle. A number of applications like traffic preservation, tracking stolen cars, mechanical electronic Toll collection system etc are used by number plate recognition systems. However, the major purpose of these systems is to manage the traffic running system efficiently. The traffic administration system is increasing gradually in a country like India. The number plates having white backdrop with black forefront color are utilized for personal cars in India. In the same way, the yellow color is utilized as backdrop and black color is used as forefront in commercial vehicles. The number plate starts with two digit letter having "state code". The state code is followed by two digit number which in turn followed by a single letter with four digits. Some steps are followed by the vehicle number plate detection system for detecting a number plate. These steps are identified as image acquisition, image pre-processing, license plate localization, character segmentation and character recognition.

The primary step in number plate detection is image acquisition. In this step, a camera is used to capture the image. A low resolution camera can also be utilized for image capturing. This system provides help to the running of the algorithm in an active situation. This step also assists in license plate localization and character extraction. If the image given by the image acquisition system is even and reasonable under all of its operational circumstances, then this system is called good [3]. This structure is built up of imaging system and the sensor network. The second step in number plate detection is Pre-processing. The image preprocessing is a very important step as it improves the quality of the image. The required features can be extracted using preprocessing. These extracted features are used for more study. In this process, various preprocessing methods are applied on the image. In this process, the area of interest is predefined on basis of the place e.g. flat, inclined or declined surface. In this process, the interested region gets cropped and transformed to a grayscale format. This is done to decrease processing time and the difficulty of the algorithm. The grayscale format is further improved for making the boundaries more the edges more clear. Some significant constraints such as color contrast, lighter boundaries of the object, etc. can be vanished due to the transformation of image from RGB to grey format. In

Revised Manuscript Received on August 05, 2019.

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order to abolish these losses and improve the boundaries, the dilation process is applied on the images. The third step in number plate recognition is license plate localization [4]. In this step, the particular license plate is bounded from the better vision. Two methods called morphological processing and edge processing are used for localizing the number plate. Morphology is described as an exact shape or formation. It is identified as a compilation of nonlinear tasks associated to the shape of an image in image processing. This procedure improves the bright areas bounded by dark areas and overturn is factual for dark areas bounded by bright area. The sudden changes of discontinuities are indicated by the edges also known as boundaries. A changeover from comparatively dark to light areas can be observed in a license plate. This means that characters, white spaces and these changeovers are regarded as edges. The histograms of the processed edges are plotted in the edge processing method. The processing of these edges is done in both horizontal and vertical directions for providing a possible area of the license plate [5]. The fourth step is image Segmentation. In this process, the involved image is divided into certain areas of identical features. This technique uses the application of the edge operators for segmentation purpose. The image obtained from edge detection cannot be utilized as a segmentation outcome. Additional processing steps should be applied for combining edges into edge chains. Dilation operation is the next step of number plate detection system. In this step, dilation operation along with rectangular Structuring Element (SE) of size 3X3 is carried out on the binary picture. It is a morphological conversion that unites two sets with the help of vector addition of set SEs. The final step in number plate detection is called character recognition [6]. This step is performed by making comparison with the pre-stored template. The characters might be distorted and noisy due to the improper condition of number plate. The character recognition methods must handle all these flaws.

II. RELATED WORK

Junaid Ali Khan, et.al (2017) proposed an improved car number plate recognition (ECNPR) system [7]. The proposed system could identify various designs and font styles of the number plates of the cars. This study made a threefold attempt. At first, numerous templates matching were utilized to recognize the characters. The recognized characters were of different fonts and sizes. In the second step, the noise was removed animatedly through the adjustment of pixel value. In the final step, a more demanding dataset was created and utilized. This dataset include various font styles and designs of number plates. The tested outcomes depicted that the modification of CNPR proposed approach showed superior results in terms of some parameters such as false positive and false negative values.

Isaias Tesfu Negassi, et.al (2018) proposed a novel and intelligent car plate recognition system [8]. The proposed interface behaved as a primary stage of a scheme by transforming the major entry of the ability to a completely automatic car entry control system. The proposed approach reduced the intensity of staff watching at the major entrance points. This stage included the creation of a database of

plates' numbers. This database created the major processing border and simulated the controller as man aid system. This system utilized a graphical user interface to process and handled the entrée to the car.

Madhusree Mondal, et.al (2017) stated that an effort had been made for recognizing the states of a vehicle using number plate [9]. For this purpose, some self generated features using CNN were used. The preliminary outcomes achieved from this work were extremely inspired. These results very efficient even with an extremely less amount of training patterns. However the implemented research showed a capable prospect of CNN approach for this type of automation applications. On the other hand, the real concerns lied on the real time execution of CNN approach.

Hussni Mubarak, et.al (2017) presented a brief review of different stages and steps involved in the automatic number plate recognition system [10]. These steps included image acquisition, pre-processing, edge setting, and image splitting and image recognition. Initially, a camera was used for image capturing. In the next phase called preprocessing, several filters were used to improve the image and placed it up for the subsequent phase. In the third phase, morphological operations were performed to the boundaries. These operations divided required regions. The pattern matching technique was utilized to identify the contents of the image. The investigators provided an instrument for the extraction of the numbers of electronic plates on the basis of earlier analysis. Around 33 samples of Sudanese car plates were used to test the research. The tested outcomes revealed that the model showed an accuracy rate of 90.06% in extracting the numbers of vehicle plate with better competence.

Junaid Ali Khan, et.al (2016) presented an improved version of one of the earlier CNPR algorithms [11]. The main aim of this study was to provide numerous templates matching in the view of light intensity and identify the number plate of the vehicle even in the dark light and autonomy of the distance of vehicle number plate to the camera. The participation of diverse situations and outside aspects truly improved the CNPR system in an efficient way. A number of tests were conducted on various number plates of the vehicles. In terms of false positive and false negative values, the projected enhancements gave superior outcomes for the CNPR system. Binay Binod Kumar, et.al (2015) stated that colorization technique and smooth L0 (SL0) minimization were used to obtain a high rate density of the color pictures [12]. The color image was transformed into Ycber space at encoder stage. The fuzzy-c-means technique was used for segmenting luminance (Y) information of the image. This technique was used to build colorization matrix. In order to select some significant color envoy pixels (RP) using SL0 algorithm, this colorization matrix was utilized. The method employed to choose RPs strongly affected the quality of rebuild color image. Some constraints such as MSE, PSNR and SSIM were used to measure the quality of the rebuild image. It was analyzed that reasonably superior density rate was attained with high-quality image.

III. RESEARCH METHODOLOGY

Following are the general steps applied to detect weed using image processing:

a. Image Acquisition: To increase the accuracy in RGB format, the images of weed are collected from online dataset with the help of a high resolution camera. Within a respective size and in jpg format, every achieved image is stored. b. Pre-processing: There are several factors based on which the obtained images are affected. The poor resolution of an image and unwanted background, the noise, and the lighting variations are few of such factors. To perform RGB to Gray scale conversion, certain pre-processing tools are applied. Further, the noise and unwanted objects from background are removed using the filtering techniques such that the gray scale images can be converted to binary image. c. Segmentation and Feature Extraction: To detect the car number plate, the features are extracted after pre-processing. A process in which a set of features are defined such that an efficient representation can be seen for analysis and classification is known as feature extraction. There are various types of features existing in an image. The DWT algorithm is used for the feature extraction. The DWT algorithm use the “Haar ” wavelet for the feature extraction. The region based segmentation approach called k-mean is used for the segmentation. In the k-mean segmentation, the centroid points are selected and from that points Euclidian distance is calculated which can segment the data into certain classes.

d. Classification: For car number plate classification, this step is performed. An input is given to the classifiers in the form of feature vectors. The images of various car number plate are used to train, validate and test the classifiers in classification process. Numerous classifiers have been designed by researchers over the years. The KNN classification method is applied for the classification. K-Nearest Neighbor classifier is a simple classifying approach in the machine learning methods where the classification is attained through the identification of the adjacent associates to enquiry illustrations and then utilizes those associates for determining the group or class of the doubt. In K-Nearest Neighbor classifier, the classification i.e. to which group the specified point belongs is relied on the computation of the least remoteness amid the specified point and other points. In the form of a classifier, the closest associate does not comprise any kind of training procedure. It is not appropriate in case of huge amount of training illustrations as it is not vigorous to noisy information. For the plant leaf categorization, the Euclidean distance amid the test patterns and training samples are computed. In this way, it discovers analogous ways and consequently the class for test patterns. A pattern is classified on the basis of maximum amount of votes from the k neighbours, by means of the pattern being allocated to the class mainly frequent amid its k nearest neighbors.

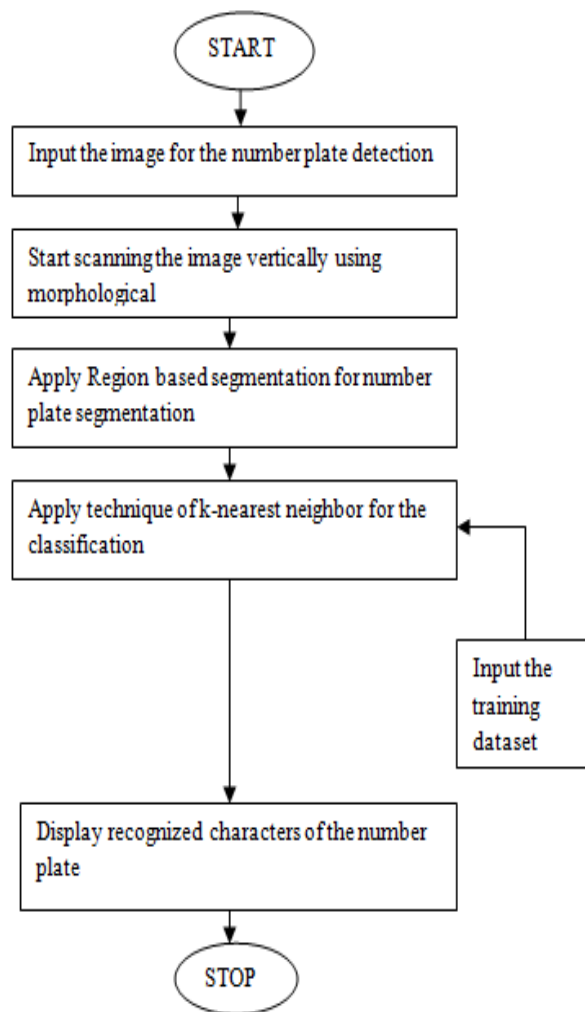


Figure 1: Proposed Flowchart

IV. RESULTS AND DISCUSSION

This research work is related to car number plate detection. The approach which is proposed in this work is based on the segmentation and classification. The region based segmentation approach is applied and k-nearest neighbor approach is used for the classification. The dataset is collected from different internet sources. The complete process of number plate detection is shown in this figure shown below:

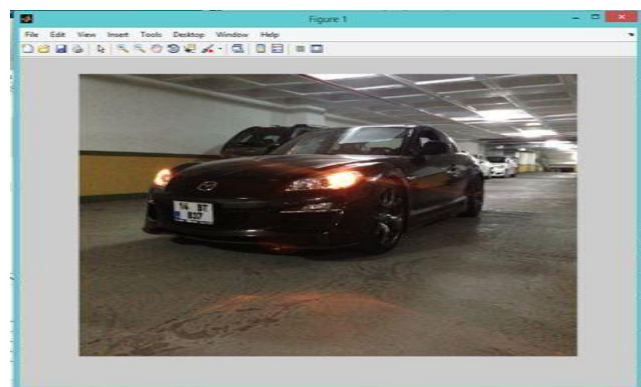


Figure 2 : Car Input for Number Plate Detection

As shown in the figure 2, the interface is planned which will identify the number plate from the car furthermore distinguish car body. The car image is given as contribution to recognize number plate from the car.

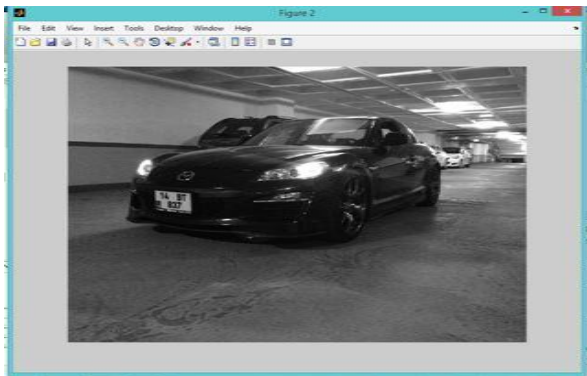


Figure 3: Pre-processing of Input Image

As shown in the figure 3, the interface is composed which will identify the number plate from the car furthermore recognize car body. The car image is given as contribution to identify number plate from the car. The car image is changed over into dim scale to perceive number plate.

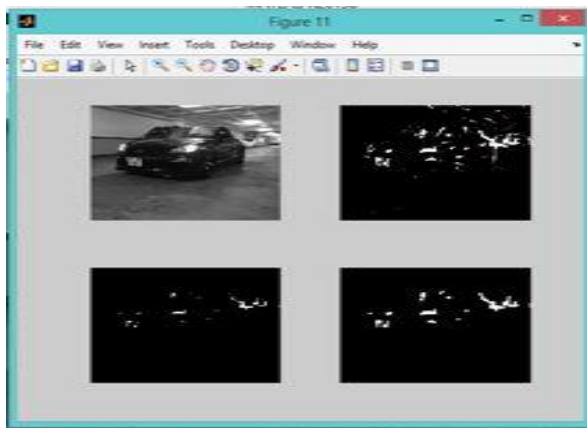


Figure 4 : Car Image Slicing

As shown in the figure 4, the interface is designed which will detect the number plate from the car and also detect car body. The car image is given as input to detect number plate from the car. The car image is converted into gray scale to recognize number plate. The gray scale image is sliced into many parts and each part will be treated independently. The slicing is applied to detect number plate area from the image.

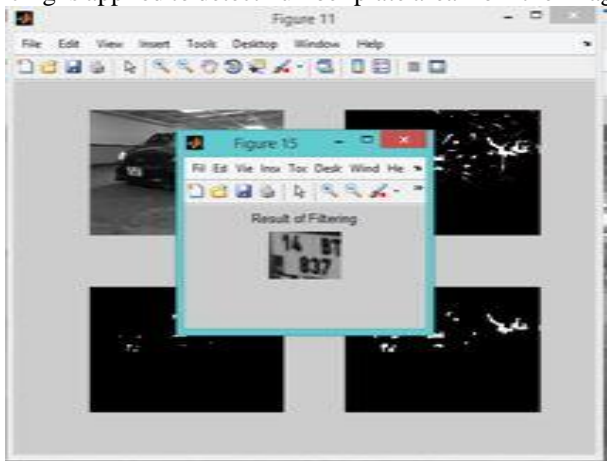


Figure 5 : Number Plate Detection with Filtering

As shown in the figure 5, the interface is outlined which will recognize the number plate from the car furthermore distinguish car body. The car image is given as contribution to distinguish number plate from the car. The car image is changed over into gray scale to perceive number plate. The gray scale image is cut into numerous parts and every part will be dealt with autonomously. The slicing is connected to recognize number plate region from the image. At the point when the car number plate is identified, the number plate is perceived from the car image. The filter is connected on the distinguished image to expel noise from the image.

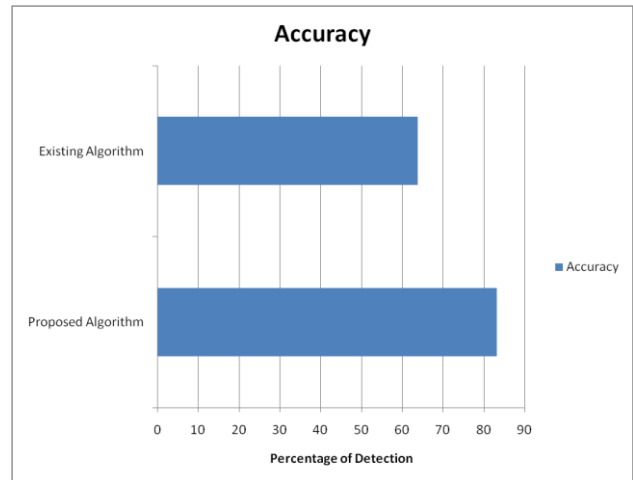


Figure 6 : Accuracy Comparison

V. CONCLUSION

The number plate detection is the approach which is applied to detect car number plate. The car number plate detection has the various phases like pre-processing, segmentation and classification. In the phase of pre-processing input images can be de-noised. The approach of region based segmentation is applied for the number plate segmentation. In the last phase, the approach of KNN classification is applied for the character recognition. The proposed approach is implemented in MATLAB and results are analyzed in terms of accuracy. It is analyzed that classification method shows better accuracy as compared to morphological operation.

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